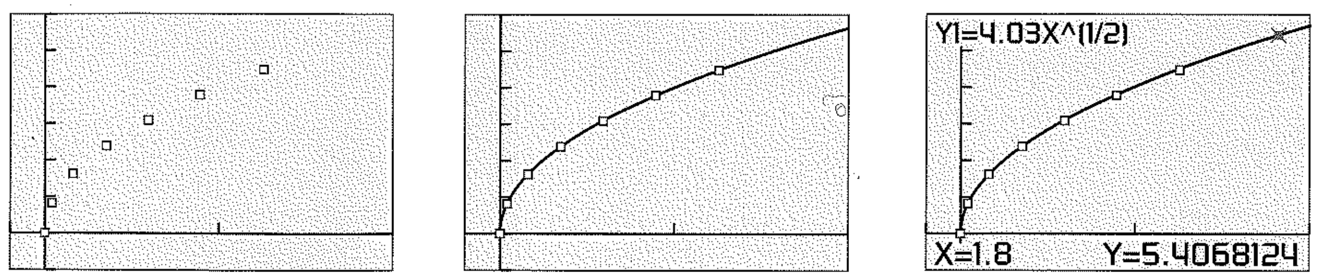


[–0.2, 2] by [–1, 6]
(a)

[–0.2, 2] by [–1, 6]
(b)

[–0.2, 2] by [–1, 6]
(c)

FIGURE 2.18 Scatter plot and graphs for Example 6.

A WORD OF WARNING

The regression routine traditionally used to compute power function models involves taking logarithms of the data, and therefore, all of the data must be strictly positive numbers. So we must leave out (0, 0) to compute the power regression equation.

Solve Numerically

To predict the speed at impact, we substitute $d \approx 1.80$ into the obtained power regression model:

$$p(1.80) \approx 5.4.$$

See Figure 2.18c.

Interpret

The speed at impact is about 5.4 m/sec. This is slightly less than the value obtained in Example 8 of Section 2.1, using a different modeling process for the same experiment.

Now try Exercise 57.

QUICK REVIEW 2.2 *(For help, go to Section A.1.)*

In Exercises 1–6, write the following expressions using only positive integer powers.

1. $x^{2/3}$ **2.** $p^{5/2}$
3. d^{-2} **4.** x^{-7}
5. $q^{-4/5}$ **6.** $m^{-1.5}$

In Exercises 7–10, write the following expressions in the form $k \cdot x^a$ using a single rational number for the power a.

7. $\sqrt{9x^3}$ **8.** $\sqrt[3]{8x^5}$
9. $\sqrt[3]{\dfrac{5}{x^4}}$ **10.** $\dfrac{4x}{\sqrt{32x^3}}$

SECTION 2.2 EXERCISES

In Exercises 1–10, determine whether the function is a power function, given that c, g, k, and π represent constants. For those that are power functions, state the power and constant of variation.

1. $f(x) = -\dfrac{1}{2}x^5$ **2.** $f(x) = 9x^{5/3}$
3. $f(x) = 3 \cdot 2^x$ **4.** $f(x) = 13$
5. $E(m) = mc^2$ **6.** $KE(v) = \dfrac{1}{2}kv^5$
7. $d = \dfrac{1}{2}gt^2$ **8.** $V = \dfrac{4}{3}\pi r^3$
9. $I = \dfrac{k}{d^2}$ **10.** $F(a) = m \cdot a$

In Exercises 11–16, determine whether the function is a monomial function, given that l and π represent constants. For those that are monomial functions state the degree and leading coefficient. For those that are not, explain why not.

11. $f(x) = -4$ **12.** $f(x) = 3x^{-5}$
13. $y = -6x^7$ **14.** $y = -2 \cdot 5^x$
15. $S = 4\pi r^2$ **16.** $A = lw$

In Exercises 17–22, write the statement as a power function equation. Use k for the constant of variation if one is not given.

17. The area A of an equilateral triangle varies directly as the square of the length s of its sides.

18. The volume V of a circular cylinder with fixed height is proportional to the square of its radius r.

19. The current I in an electrical circuit is inversely proportional to the resistance R, with constant of variation V.

20. Charles's Law states the volume V of an enclosed ideal gas at a constant pressure varies directly as the absolute temperature T.

21. The energy E produced in a nuclear reaction is proportional to the mass m, with the constant of variation being c^2, the square of the speed of light.

22. The speed p of a free-falling object that has been dropped from rest varies as the square root of the distance traveled d, with a constant of variation $k = \sqrt{2g}$.

In Exercises 23–26, write a sentence that expresses the relationship in the formula, using the language of variation or proportion.

23. $w = mg$, where w and m are the weight and mass of an object and g is the constant acceleration due to gravity.

24. $C = \pi D$, where C and D are the circumference and diameter of a circle and π is the usual mathematical constant.

25. $n = c/v$, where n is the refractive index of a medium, v is the velocity of light in the medium, and c is the constant velocity of light in free space.

26. $d = p^2/(2g)$, where d is the distance traveled by a free-falling object dropped from rest, p is the speed of the object, and g is the constant acceleration due to gravity.

In Exercises 27–30, state the power and constant of variation for the function, graph it, and analyze it in the manner of Example 2 of this section.

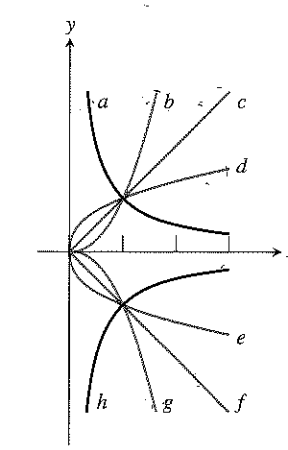
27. $f(x) = 2x^4$ **28.** $f(x) = -3x^3$
29. $f(x) = \dfrac{1}{2}\sqrt[4]{x}$ **30.** $f(x) = -2x^{-3}$

$-10^5 =$

In Exercises 31–36, describe how to obtain the graph of the given monomial function from the graph of $g(x) = x^n$ with the same power n. State whether f is even or odd. Sketch the graph by hand and support your answer with a grapher.

31. $f(x) = \dfrac{2}{3}x^4$ **32.** $f(x) = 5x^3$
33. $f(x) = -1.5x^5$ **34.** $f(x) = -2x^6$
35. $f(x) = \dfrac{1}{4}x^8$ **36.** $f(x) = \dfrac{1}{8}x^7$

In Exercises 37–42, match the equation to one of the curves labeled in the figure.



37. $f(x) = -\dfrac{2}{3}x^4$ **38.** $f(x) = \dfrac{1}{2}x^{-5}$
39. $f(x) = 2x^{1/4}$ **40.** $f(x) = -x^{5/3}$
41. $f(x) = -2x^{-2}$ **42.** $f(x) = 1.7x^{2/3}$

In Exercises 43–48, state the values of the constants k and a for the function $f(x) = k \cdot x^a$. Describe the portion of the curve that lies in Quadrant I or IV. Determine whether f is even, odd, or undefined for $x < 0$. Describe the rest of the curve if any. Graph the function to see whether it matches the description.

43. $f(x) = 3x^{1/4}$ **44.** $f(x) = -4x^{2/3}$
45. $f(x) = -2x^{4/3}$ **46.** $f(x) = \dfrac{2}{5}x^{5/2}$
47. $f(x) = \dfrac{1}{2}x^{-3}$ **48.** $f(x) = -x^{-4}$

In Exercises 49 and 50, data are given for y as a power function of x. Write an equation for the power function, and state its power and constant of variation.

49.

x	2	4	6	8	10
y	2	0.5	0.222...	0.125	0.08

50.

x	1	4	9	16	25
y	−2	−4	−6	−8	−10